



*Assessing and reducing the risk of ground-water contamination from*

# **Fertilizer Storage and Handling**

**Keeping Idaho's**

**Fact/Worksheet 3**

**— Water Clean —**

## ***Why should I be concerned?***

Fertilizers play a vital role in increasing farm production. Commercial fertilizer is a major source of nitrogen in several chemical forms, including nitrate.

In recent years nitrate-nitrogen concentrations which exceed the public health standard of 10 mg/L\* have been found in some drinking water wells. Infants less than six months of age have not developed certain enzyme systems and are particularly susceptible to health problems from high nitrate-nitrogen levels. One such condition is methemoglobinemia (blue baby syndrome). Adults may also be affected by high nitrate concentrations, but the evidence is much less certain.

Young animals may also be susceptible to health problems related to nitrate-nitrogen concentrations in the 20 to 40 mg/L range. These problems may be compounded with feeding of high nitrate-nitrogen feed sources.

Proper handling and storage of fertilizers will help prevent potential leaching of nitrate to ground water if accidental spills occur. Your drinking water is least likely to be contaminated when all appropriate management and disposal procedures are followed. Surface water may also be susceptible to contamination from nitrates if proper containment and disposal procedures are not followed.

Although fertilizers are a major source of nitrates in rural areas, other sources include septic systems, animal lots, manure storage areas, and silage storage facilities. These facilities are addressed in separate Home\*A\*Syst fact/worksheets.

**The goal of Home\*A\*Syst is to help you protect the environment and your drinking water.**

\*means milligrams per liter, equivalent to parts per million for water measure

## ***How will these materials help me to protect my drinking water?***

- It will take you step-by-step through your fertilizer storage, handling, and disposal practices.
- It will rank your activities according to how they might affect the ground water that provides your drinking water supply.
- It will provide you with easy-to-understand rankings that will help you analyze the risk level of your fertilizer storage, handling, and disposal practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require some modification to better protect your drinking water.

## ***How do I complete the worksheet?***

After reviewing the information provided, follow the directions at the top of the chart on page 8. It should take you about 15 to 30 minutes to complete the worksheet and summarize your risk rankings.

Information derived from Home\*A\*Syst worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. It is not the intent of this educational program to keep records of individual results.

# Glossary

## *Fertilizer Storage and Handling*

*These terms may help you make more accurate assessments when completing Fact/Worksheet 3. They may also help clarify some of the terms used.*

**Air gap:** An air space (open space) between the fill hose and tank water level, this is one way to prevent backflow of liquids into a well or water supply.

**Agronomic rate:** The application rate that supplies the necessary plant nutrients without over applying. A soil test is needed to determine this rate.

**Anti-backflow (anti-backsiphoning) device:** A check valve or other mechanical device to prevent the unwanted reverse flow of liquids back down a water supply pipe into a well.

**Backflow:** The unwanted reverse flow of liquids in a piping system.

**Backflow prevention device:** (See anti-backflow device.)

**Back-siphonage:** Backflow caused by formation of a vacuum in a water supply pipe.

**Closed handling system:** A system for transferring pesticides or fertilizers directly from container to application equipment that minimizes the chance of exposure to the handler or environment.

**Commercial fertilizer:** Any substance that contains one or more recognized plant nutrients, has been biologically or chemically altered, and is used to promote plant growth. Composted manure is considered commercial fertilizer; raw manure is not.

**Cross-connection:** A link or channel between pipes, wells, fixtures, or tanks carrying contaminated water and those carrying potable (safe for drinking) water. Contaminated water, if at higher pressure, enters the potable water system.

**Micrograms per liter (ug/L):** The weight of a substance measured in micrograms contained in one liter. It is equivalent to 1 part per billion in liquid measure.

**Milligrams per liter (mg/L):** The weight of a substance measured in milligrams contained in one liter. It is equivalent to 1 part per million in liquid measure.

**Parts per billion (ppb):** A measurement of concentration of one unit of material dispersed in one billion total units.

**Parts per million (ppm):** A measurement of concentration of one unit of material dispersed in one million total units.

**Rinsate:** Rinse water resulting from cleaning the insides of farm chemical containers or application equipment.

**Secondary containment:** Impermeable floor and walls around a fertilizer storage area that minimize the amount of fertilizer seeping into the ground from a spill or leak.

**Wash water:** Solution containing very low concentrations of farm chemicals resulting from cleaning the exterior of application equipment.



# Improving Fertilizer Storage and Handling

## Keeping Idaho's

## Water Clean

### 1. Fertilizer storage practices

When stored safely in a secure location, fertilizers pose little danger to ground water. Keep fertilizer dry and out of the way of activities that might rip open a bag or allow moisture to enter a bulk container.

Locate fertilizer storage areas downslope and at least 400 feet away from your well to provide reasonable assurance well water will not be contaminated. Separation from the well should be greater in areas of sand or fractured bedrock. Worksheet A, *Site Evaluation*, can assist you in ranking your homestead soils and geologic conditions by their ability to keep contaminants out of ground water.

#### *Managing your existing storage facility*

Compared to the cost of a major accident, or even a lawsuit, storage improvements can be a bargain. Your cheapest alternative may be to cut back on the amount of fertilizer you store. If that option is not practical, consider how you can protect the fertilizers you keep on hand.

- A locked storage area or building provides security by reducing the chance of accidental spills or theft. Use signs and labels to indicate that the area or building is for fertilizer storage.
- Sound containers are your first defense against a spill or leak. If a bag is accidentally ripped, confine the fertilizers to the immediate area and recover them promptly.
- Provide pallets to keep bags off the floor. Store dry products separate from liquids to prevent wetting from spills.
- If you plan to store large bulk tanks, provide a containment area large enough to confine 125 percent of the contents of the largest bulk container, plus the displaced volume of any other storage tanks. Contact the Idaho Department of Agriculture (IDA) at (208) 334-3550 for more detailed information.
- Store fertilizer separately from pesticides.

Ideally, your fertilizer storage area should be separate from other activities. If the building also serves as a machine shed or as housing for animals, you may find it difficult to meet all the requirements for safe storage.

Fires in a storage area can pose a danger to firefighters and to the environment. Reducing the fire risk in the storage area may be the first step, but other things can be done. You can reduce the damages by anticipating such emergencies. Label windows and doors to alert firefighters to the presence of fertilizer stored in the structure. If a fire should occur, consider where the water will go and where it might collect. A curb around the floor can help confine contaminated water. In

making the storage area secure, also make it accessible, allowing you to get fertilizers out in a hurry.

### ***Building a new storage facility***

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While a new facility just for fertilizer storage may be expensive, it may be safer than trying to adapt areas meant for other purposes. Keep the principles in mind that were mentioned above. Safe storage can minimize the risk of accidents and spills around your fertilizer storage area.

In the event of an accidental spill, an impermeable (waterproof) floor, such as concrete, helps to prevent fertilizer seeping into the ground and leaching to ground water. A curb built around liquid fertilizer storage areas will prevent contaminants from spreading to other areas.

For bulk liquid fertilizer storage, secondary containment provides an impermeable floor and walls around the storage area, which will minimize the amount of fertilizer seeping into the ground if a tank should rupture or leak.

A properly designed mixing/loading pad can provide for collection of spills that may occur during the transfer of fertilizer to application equipment or nurse tanks. If you must store piles of dry bulk fertilizer, place them on an impermeable surface under cover or in a building. Treat dry fertilizer impregnated with a pesticide, as a pesticide. Store under cover or protect from rain. See *Fact/Worksheet 2* for more information concerning pesticide storage and handling practices.

For information on factors to consider in designing a storage facility, such as ventilation, temperature control, and worker safety, contact the IDA (208) 334-3550 or your county Cooperative Extension System office or Extension Agricultural Engineer, (208) 885-7626, for plans and recommendations. Secondary containment draft rules are being developed by IDA.

## **2. Mixing and loading practices**

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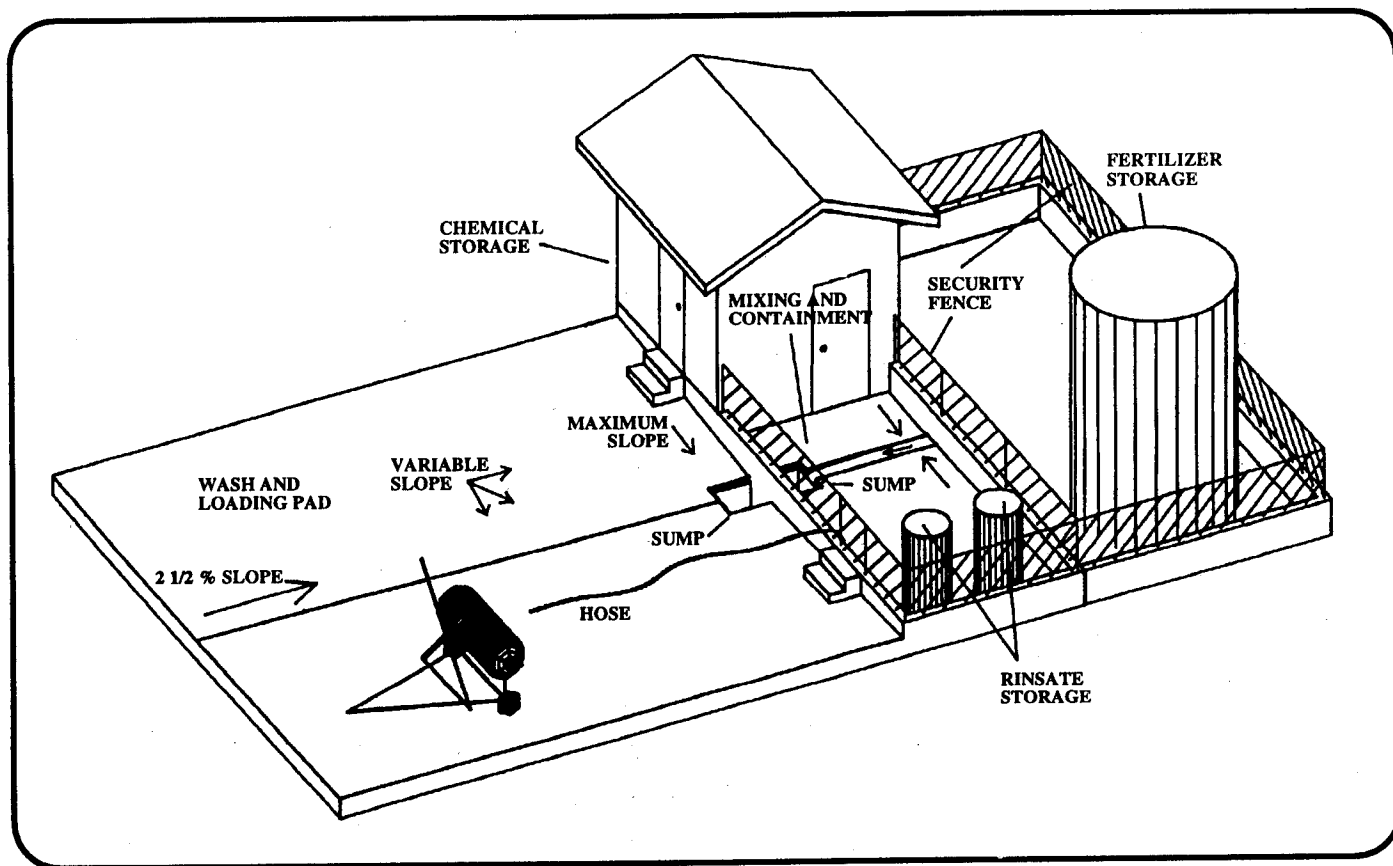
Ground-water contamination can result from small quantities spilled regularly in the same place. Spills of dry fertilizer should be promptly and completely cleaned up and placed immediately into the application equipment. Cleaning up spills of liquid fertilizers can be much more difficult.

### ***Better management of your existing mixing and loading site***

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Liquid fertilizer spills and leaks are bound to occur from time to time. Even if you don't have an impermeable mixing and loading pad, you can minimize contamination by following some basic guidelines:

- Avoid mixing and loading fertilizers near your well. One way to do this is to use a nurse tank to transport water or fertilizer to the field mixing and loading site. Ideally, the site should be moved from year to year within the field of application.
- Avoid mixing and loading on gravel driveways or other surfaces that allow spills to sink quickly through the soil. A clay surface is better than sand or gravel.
- Install an anti-backsiphon device on the well or hydrants. Never put the hose in the applicator tank. Provide an air gap of six inches between the hose and the top of the applicator tank.
- Always supervise applicator filling.
- Consider using a closed handling system in which the fertilizer is directly transferred from the original container to the application equipment, such as by a hose.
- Use rinsate as part of current fertilizer application or mix with subsequent loads. Always apply fertilizer at recommended agronomic rates.



**Figure 1: Farm-sized fertilizer facility.** Source: *Modular Concrete Wash/Containment Pad for Agricultural Chemicals*, by R.T. Noyes and D.W. Kammel. American Society of Agricultural Engineers Paper Number 891613.

### ***A liquid fertilizer mixing and loading pad***

Containing liquid fertilizer spills and leaks requires an impermeable surface (such as coated or sealed concrete) for mixing and loading. A concrete pad should be large enough to accommodate your equipment and to contain leaks from bulk tanks, wash water, and spills from transferring fertilizers to the applicator (*Figure 1*).

Locate the pad adjacent to the storage area. At sites where runoff may occur, construct a diversion to direct runoff away from the well.

The size of the pad depends on the equipment you use. It should provide space around the parked equipment for washing and rinsing. The fertilizers and rinse water should drain to a collection area, such as a sump, for transfer to rinsate storage tanks. Having several separate rinsate storage tanks allows you to keep rinse water from different fertilizer chemical mixes separate. That way, it can be used for mixing water on subsequent loads.

If you are considering constructing a mixing/loading pad, more detailed information is available from county Cooperative Extension System offices or Extension Agricultural Engineer at (208) 885-7626.

### 3. Spill cleanup

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For dry spills, promptly sweep up and use the fertilizer as it was intended. Dry spills are usually very easy to clean up. Dry pesticide-impregnated fertilizer is considered a pesticide and, if spilled, should be recovered and applied to the target crop as it was intended.

For liquid spills, recover as much of the spill as possible and use as it was intended. Some soils contaminated with fertilizer may be required to be removed and field applied at recommended agronomic rates.

Cleanup of a spilled or discharged dangerous waste or hazardous substance must be done immediately. If the person responsible for a spill or discharge is uncertain of its possible significance, notification and/or request for assistance from Idaho State Poison Control is encouraged. It is also expected that control and stabilization of a spill or discharge (e.g. shutting off an open valve or righting an overturned drum) would come first, provided that such activity could be done safely.

For dry spills, promptly sweep up and use the pesticide as it was intended. Dry spills are usually very easy to clean up. For liquid spills, recover as much of the spill as possible. Recovery in the original liquid form is recommended. Otherwise use soil, sawdust or other absorbent material, and place it in a sealable container. It may have to be disposed of as hazardous waste. Contact IDA, Idaho Department of Health and Welfare-Division of Environmental Quality (IDHW-DEQ), a hazardous waste contractor, or your local public health district for disposal procedures.

Spills are generally considered a threat to human health or the environment and should be reported immediately. Spills or discharges within containment structures that are cleaned up in a timely manner typically do not need to be reported. For example, shop floors, concrete pads, or drip pans could be considered barriers to the environment if they are able to prevent contact with the environment. Do not use containment structures to store or accumulate dangerous wastes.

Have an emergency response plan for the site. Know where the runoff water will go, how to handle your particular fertilizers, and whom to call for help.

For further information or assistance or to report spills, contact the nearest Poison Control (800) 632-8000, IDA, or one of the following DEQ offices:

North (Coeur d'Alene):	(208) 769-1422
North Central (Lewiston):	(208) 799-4370
Southwest (Boise):	(208) 373-0550
South Central (Twin Falls):	(208) 736-2190
Southeast (Pocatello):	(208) 236-6160
Eastern (Idaho Falls):	(208) 528-2650

For an updated version of the Idaho Fertilizer Containment Rules, contact IDA at (208) 334-3550.

## **4. Container disposal practices**

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Bulk deliveries of anhydrous ammonia, liquid fertilizers, and dry fertilizers have reduced the need to dispose of containers. Many farmers do, however, use bagged fertilizers. Empty bags should be bundled and stored at least 400 feet away from your well, and disposed of properly, preferably in an approved landfill.

Your drinking water is least likely to be contaminated by your disposal practices if you follow appropriate management procedures. However, proper offsite disposal practices, such as disposal at an approved landfill, are essential to avoid risking contamination that could affect the water supplies and health of others.

## **5. Other management factors**

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Reducing fertilizer waste makes financial as well as environmental sense, but it means more than just reducing spills. It also means not buying more than you need to apply and keeping records of what you do have on hand. Buying only what you need makes long-term storage unnecessary.

Keeping records may seem like a task unrelated to ground-water contamination, but knowing what you've used in the past and what you have on hand allows you to make better purchasing decisions. Keep records of past field application rates and their effectiveness.

## Worksheet 3

# Fertilizer Storage and Handling: Assessing Drinking Water Contamination Risk

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your homestead, read across to the right and circle the statement that **best** describes conditions on your homestead (skip and leave blank any categories that don't apply to your homestead).
3. Then look above the description you circled to find your "rank number" (4, 3, 2, or 1) and enter that number in the blank under "your rank."
4. Complete the section "What do I do with these rankings?"
5. Allow about 15 to 30 minutes to complete the worksheet and summarize your risk rank for fertilizer storage and handling practices.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
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## FERTILIZER STORAGE (Addressed in Section 1)

### Dry formulation

Amount stored	None stored at any time.	Less than 1 ton stored.	Between 1 and 25 tons stored.	More than 25 tons stored.	
Storage site	Concrete or other impermeable secondary containment does not allow spill to contaminate soil.	Covered on clay soil. Spills are collected.	Partial cover on loamy soils.	No cover on sandy soils. Spills not collected.	

### Liquid formulation

Amount stored	None stored at any time.	Less than 55 gallons stored.	Between 55 and 500 gallons stored.	More than 500 gallons stored.	
Storage site	Concrete or other impermeable secondary containment does not allow spill to contaminate soil.	Clay-lined secondary containment. Most of spill can be recovered.	Moderately permeable soils (loam). No secondary containment. Most of spill cannot be recovered.	Highly permeable soil (sand). No secondary containment. Spills contaminate soil.	
Length of storage period	Less than 1 month	1 to 3 months	3 to 6 months	More than 6 months	

Containment regulations being developed by IDA, regulatory trigger quantities will be determined, contact IDA.



	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
<b>FERTILIZER STORAGE (continued)</b>					
Location of storage area in relation to well location	400 feet or more downslope from well.	200 to 400 feet downslope from well.	100 to 200 feet downslope from well.	Within 100 feet* or upslope from well.	_____
Containers	Original containers clearly labeled. No holes, tears, or weak seams. Lids tight.	Containers aging. Poorly labeled or hard to read.	Containers patched. Metal containers showing signs of rusting. Labels missing.	Containers have holes or tears that allow fertilizers to leak. No labels.	_____
Security	Fenced and locked or otherwise secured area separate from all other activities. Locks on valves.	Fenced area separate from most other activities.	Open to activities that could damage containers or spill fertilizer.	Open access to theft, vandalism, and children.	_____
Storage of other products and materials	Area dedicated for fertilizer storage.	Area shared with machinery storage.	Shared area with other farm chemicals.	Area of common use for animals and other chemicals.	_____
<b>MIXING AND LOADING PRACTICES (Addressed in Sections 2 and 3)</b>					
Location of mixing/loading area in relation to well	400 or more feet downslope from well.	200 to 400 feet downslope from well.	100 to 200 feet down-slope from well.	Within 100 feet* or upslope from well.	_____
Spill protection for dry materials	Protected from wind. Surface impervious with easy cleanup or loading in field of use.	Open area with easy cleanup.	Open area, cleanup a chore.	Graveled surface on sandy soil.	_____
Spill protection for liquids	Sealed concrete pad slopes to collection point or sump that allows easy recovery of spill.	Loading in field of use. Change location each fill. Spills cleaned up promptly.	Flat concrete pad with some cracks. No curb or sump. Spills not cleaned up promptly.	No loading pad on porous soil. Same site each load. Spills not cleaned up.	_____

\* This practice represents a high risk choice.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
<b>ADDITIONAL MIXING AND LOADING PRACTICES FOR LIQUID FERTILIZER (continued)</b>					
<b>Loading/filling supervision</b>	Constant by trained individual.	Constant by whoever is handy.	Periodic.	Seldom or never. Occasional spills.	_____
<b>Water source</b>	Separate water tank.	_____	_____	Obtained directly from water well, stream, or pond.	_____
<b>Backflow prevention on water supply</b>	Anti-backflow device installed. Six-inch air gap maintained above sprayer tank.	Anti-backflow device installed. Hose in tank above waterline.	No anti-backflow device. Hose in tank above waterline.	No anti-backflow device. <b>Hose in tank below water line.</b>	_____
<b>Liquid handling system</b>	Closed system for all liquid product transfers.	Closed system for most liquids. Some liquids hand poured. Sprayer fill port easy to reach.	All liquids hand poured. Sprayer fill port easy to reach.	All liquids hand poured. Sprayer fill port hard to reach.	_____
<b>CLEANUP AND DISPOSAL PRACTICES (Addressed in Section 4)</b>					
<b>Container disposal</b>	Returned to supplier, or reusable container.	Taken to approved landfill.	Disposal of empty containers on property.	Disposal of partially filled containers on property.	_____
<b>Application equipment cleaning and rinsate disposal</b>	Application equipment rinsed in field. Rinsate applied to crop or pasture ground at agronomic rate.	Application equipment rinsed on pad at homestead. Rinsate applied to crop or pasture ground at agronomic rate.	Application equipment rinsed at homestead. Rinsate applied around yard. Not applied at agronomic rate.	Application equipment rinsed at homestead. Rinsate allowed to drain in one spot.	_____

**Boldface type:** Besides representing a higher risk choice, this practice violates Idaho law.

## What do I do with these rankings?

Step 1: In the table below, summarize your risk scores by checking the appropriate box for each category you answered on this worksheet.

### Fertilizer Storage and Handling Risk Rankings Summary

CATEGORY	Risk Rank			
	Low 4	3	2	High1
Amount of dry formulation stored				
Type of storage				
Amount of liquid formulation stored				
Type of storage				
Length of storage period				
Location of storage area in relation to well				
Containers				
Security				
Storage of other products and materials				
Location of mixing/loading area in relation to well				
Spill protection for dry materials				
Spill protection for liquids				
Loading/filling supervision				
Water source				
Backflow prevention on water supply				
Liquid handling system				
Container disposal				
Application equipment cleaning and rinsate disposal				

**Step 2: Look over your rankings for individual activities.**

**High Risk Practices (1)** Pose a high risk for your health and for contaminating ground water.

**Moderate to High Risk Practices (2)** Are inadequate protection in many circumstances.

**Low to Moderate Risk Practices (3)** Provide reasonable ground-water protection.

**Low Risk Practices (4)** Are ideal; try to make this your goal.

Any shaded rankings require immediate attention. Some concerns you can take care of right away; others could be major or costly projects, requiring planning and prioritizing before you take action. The long term goal of the **Home\*A\*Syst** program is to improve homestead practices and structures so that they are classified as low risk. Activities classified as low risk generally reflect best management practices.

**Transfer any activities that you ranked in the shaded areas in step 1 to the "High-Risk Activities" on pages two, three, and four of Worksheet B.**

**Step 3: Read the materials provided in this document if you haven't already. Consider how you might modify your homestead practices to better protect your drinking water.**

## **Contacts and References**

### **Who to call about...**

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#### **Plans and recommendations for fertilizer mixing and loading pads**

- Your county Cooperative Extension System office or Cooperative Extension Agricultural Engineer, (208) 885-7626.

#### **Fertilizer storage and containment rules**

- Call IDA, (208) 334-3550.

#### **Fertilizer spills and proper disposal of soil contaminated by a fertilizer spill**

- Call IDA, DEQ, your local public health district, or emergency coordinator.

#### **Health effects of nitrates in drinking water**

- Contact the DEQ, local public health district, or the IDA (208) 334-3550. This is the department's general information contact for all health related issues.

#### **Drinking water quality and treatment**

- EPA Safe Drinking Water Hotline, Monday through Friday, 6:30 a.m.– 3 p.m. Pacific Standard Time, call (800) 426-4791, or the DEQ.
- The reporting numbers for the DEQ regional offices are:

North (Coeur d'Alene):	(208) 769-1422
North Central (Lewiston):	(208) 799-4370
Southwest (Boise):	(208) 373-0550
South Central (Twin Falls):	(208) 736-2190
Southeast (Pocatello):	(208) 236-6160
Eastern (Idaho Falls):	(208) 528-2650

## **What to read about...**

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*Publications are available from sources listed at the end of the reference section. Refer to number in parentheses after each publication.*

### **Ground-water contamination, protection, and testing**

- Quality Water for Idaho: Nitrate and Groundwater - CIS 872 (1)
- Quality Water for Idaho: Water Testing - CIS 873 (1)
- Idaho's Water Resources - CIS 887 (1)
- Quality Water for Idaho: Groundwater In Idaho - CIS 900(1)
- Best Management Practices for Nitrogen Management to Protect Surface Water - CIS-962 (1)
- A list of laboratories certified to conduct water sample analyses is available from your Cooperative Extension System agent or local health district.

### **Health effects**

- The product label. Read your product labels carefully for specific information on fertilizer health effects.
- *Nitrates and Groundwater: A Public Health Concern*. Freshwater Foundation. (4)

### **Fertilizer storage, handling, disposal, and safety**

- *Designing Facilities for Pesticide and Fertilizer Containment*. Midwest Plan Service. MWPS-37. (2)
- *Constructing an Inexpensive Ag Chemical Rinse Pad*. ACRE fact sheet 14. (5) Discusses capturing wastewater, storage of chemicals, site selection, and the design of a simple rinse pad.
- *Disposing of Crop Protection Chemical Containers*. ACRE fact sheets, 5 and 12. (5) Fact sheet 5 provides an eight-point checklist of procedures to follow for safe disposal of chemical containers. Fact sheet 12 discusses pressure-rinsed and triple-rinsed containers and rinsed container disposal.
- *Chemicals in Your Community: A Guide to the Emergency Planning and Right To Know Act*. 1988. U.S. Environmental Protection Agency. (3) Pages 26-27 contain information on implications of this law for farmers.

### **Publications available from...**

- Your county Cooperative Extension System office. There may be charges for the publications, postage, and sales tax.
- Midwest Plan Service, Iowa State University, Ames, Iowa, 50011, (515) 294-4337.
- U.S. Environmental Protection Agency (EPA), Office of Pesticide Programs (S-766C), 401 M Street S.W., Washington, D.C. 20460.
- Freshwater Foundation at Spring Hill Center, 725 County Road 6, Wayzata, Minnesota, (612) 449-0092.
- Alliance for a Clean Rural Environment (ACRE), P.O. 413708, Kansas City, Missouri 64141, (800) 545-5410.



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Idaho Association of Soil Conservation Districts (IASCD)  
Idaho Department of Agriculture (IDA)  
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Idaho Department of Water Resource (IDWR)  
Idaho Public Health Districts  
Idaho Soil Conservation Commission (SCC)  
Idaho Water Resources Research Institute (IWRRI)  
University of Idaho-Cooperative Extension System (CES)  
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USDA-Natural Resources Conservation Service (NRCS)  
USDA-Rural Economic and Community Development  
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Information derived from **Home\*A\*Syst** worksheets is intended only to provide general information and recommendations to rural residents regarding their own homestead practices. All results are confidential.

Programs and policies are consistent with federal and state laws and regulations prohibiting discrimination on the basis of race, color, religion, national origin, sex, age, disability, political beliefs, and marital or familial status. Trade names have been used to simplify information; no endorsement is intended.  
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